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Cc: Nathan Thomas[nthomas@blm.gov]
From: Losey, Ashley
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[NHMU BENM ProjectNarrative.pdf](#)

Attached is the proposal we accepted and funded. I have not yet read it thoroughly, but it seems to have a decent amount in common with what we've discussed.

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BUREAU OF LAND MANAGEMENT
Financial Assistance (Cooperative Agreements)



ATTACHMENT A: PROJECT PROPOSAL (SUGGESTED FORMAT)

Instructions: A Project Proposal must be submitted with the Standard Form (SF) 424 Application for Federal Assistance for all BLM Assistance Agreements. Complete each section below. Use additional sheets as needed.

Person Submitting Proposal: Lisbeth Louderback Date: 2/1/2017

Organization Name: Natural History Museum of Utah, University of Utah

Agreement or Announcement No.: L17AS00001

Agreement or Announcement Title: BLM FY2017 Bureau-wide National Conservation Lands
Scientific Studies Support Program

Estimated Period of Performance: May 1, 2017 to April 30, 2022

BLM POC: Allison Ginn

Proposed Project Location: Bears Ears National Monument

This work will occur on: Public Lands Both Public & Private Lands

Ecosystems and Plant Resources of Archaeological Sites in the Four Corners Region, USA

YOUR MISSION:

The management of public lands requires a broad and detailed understanding of valuable *archaeological and biological resources* that relies on science to inform and develop best practices. Research is also required to assess the significance of archaeological sites under the National Historic Preservation Act (NHPA) and such assessments profoundly influence how the archaeological site is ultimately managed. Site significance is partially determined by the potential of archaeological remains to answer important questions about the past (criterion D of a site's significance under the NHPA). However, a *comprehensive* approach would include documenting ecosystem characteristics and condition, including an inventory of associated ethnobotanical species, to inform BLM management of archaeological and biological resources in tandem, a somewhat novel hybrid of two realms of inquiry.

The archaeology of the Four Corners is a world renowned scientific endeavor. The sophistication of the Ancestral Puebloan culture, especially concerning their use of both native and early domesticated plants, tells us much about the ecology and technology of these early people. Well-known plant species such as maize, beans and squash were domesticated in Mesoamerica, transported to the Four Corners region and grown amongst the cliff dwellings and canyons like Mesa Verde, Chaco Canyon and Canyon de Chelly (Cordell and McBrinn 2012). But other lesser known species, such as the Four Corners potato (*Solanum jamesii*) (Figure 1), may have also been very important to the diet and possibly even domesticated locally (Kinder et al. 2017, Louderback and Pavlik, in review).



Figure 1. *Solanum jamesii* (left) and tubers from a single individual after one growing season.

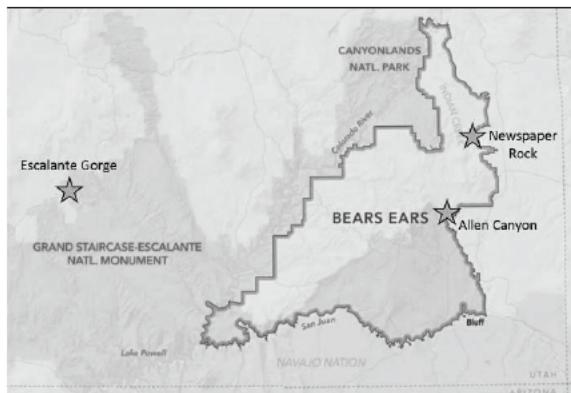


Figure 2. Map of Grand Staircase Escalante and Bears Ears National Monuments with locations of *S. jamesii* populations labeled. Map modified from Bears Ears Inter Tribal Coalition.

resources and 3) providing a detailed inventory and survey of ethnobotanically important species, including present condition, threats and management recommendations. The inventory will be entered into an existing ethnobotanical database (<https://nhmu.utah.edu/native-plants>) for the Colorado Plateau. This database, which was developed in partnership with the BLM (Applegate office in CA), will help inform resource

management decisions to sustain landscapes, preserve archaeological resources, and conserve traditionally used plants within lands managed by the BLM. The database will also promote research on past human diets, environmental changes, and regional ethnography.

To bring an understanding of National Conservation Land ecosystems for purposes of resource management, we are emphasizing the importance of a broad perspective of cultural resource management that includes the conservation of not only archaeological sites, but their surrounding ecosystems. We already know of archaeological sites in Bears Ears where improved management practices could ensure the vigor of *S. jamesii* populations. For example, plants at Newspaper Rock are senescing before flowering, probably due to competition with weedy, invasive plants. Conversely, in Allen Canyon, *S. jamesii* populations are doing reasonably well in the absence of high weed cover. Populations of *S. jamesii* growing next to archaeological sites and a well-used trail in the Escalante Gorge of the Grand Staircase Escalante National Monument (GSENM) need to be mapped and included in management planning to ensure persistence.



Figure 3. Left image is Newspaper Rock with associated *S. jamesii* population. Right image is granary in Allen Canyon with *S. jamesii* population. Compare the poor condition of the Newspaper Rock population to the healthy population growing in Allen Canyon.

OBJECTIVES:

The overall mission of this project is to provide an ecosystem assessment in relation to significant archaeological sites in National Conservation Lands in the Four Corners region. In the first two years, we will focus our efforts in the Bears Ears and Grand Staircase Escalante National Monuments, but ultimately we would like to expand our study to meet the science and research needs of other National Conservation Lands in the Four Corners region. We will accomplish our overall mission by completing tasks pertaining to three specific objectives:

- Objective 1: Describe the landscape and archaeological features (the setting)
- Objective 2: Quantify the adjacent, dominant vegetation (landscape palette)
- Objective 3: Inventory and survey ethnobotanically important species (dietary palette), including present condition threats and management recommendations.

These objectives support the '**Research Identified in Unit Science Plans**' and '**Standardized Inventory and Monitoring**' (Troves et al. 2011) research themes. After an archaeological setting is described and mapped, vegetation sampling techniques (e.g. Mueller-Dombois and Ellenberg 2003) will be used to describe the dominant vegetation. From those data, we can then inventory and survey ethnobotanical species and monitor for condition threats and provide management recommendations. This comprehensive approach also supports the '**Research Syntheses**' theme because we will inform BLM management of archeological and biological resources in tandem, a somewhat novel hybrid of two realms of inquiry. Our project also encourages '**Citizen Science**' programs to engage people of the Four Corners region, especially

Native Americans, encouraging traditional cultivation and inter-generational mentoring. The ethnobotanical database portion of our project will immediately engage existing stewards of the potato by recording their memories and cultivation techniques. If we find support, we could also propagate the potato and return them to the original stewards (the true owners) for local distribution. This would facilitate the participation of local schools and youth groups with an interest in such traditions, led by people who rightfully have a claim to fully exploit this wonderful resource.

Additionally, our project contributes to all four research themes stated in the BLM Utah National Conservation Lands Strategy (<https://www.blm.gov/sites/blm.gov/files/UtahNCLStrategyFinal.pdf>).

Theme 1. Ensure the Conservation, Protection, and Restoration of National Conservation Lands Values
 We will provide a better understanding and appreciation for National Conservation Lands values by conducting ecosystem assessments, including vegetation surveys of archaeological settings and inventorying ethnobotanical species.

Theme 2. Collaboratively Managing the National Conservation Lands as Part of the Larger Landscape
 Our ecosystem-based approach is to consider the context as equally important to the archaeological site. For this reason we will include documentation of landscape vegetation and ethnobotanical species.

Theme 3. Raise Awareness of the Value and Benefits of BLM's National Conservation Lands
 Populations of *S. jamesii* in southeastern Utah are small and isolated and could be on their way to extirpation (Bamberg et al. 2003, 2016). Establishing the cultural significance and potential economic importance of *S. jamesii* could enable better conservation and restoration efforts through local stewardship.

Theme 4. Build upon BLM's Commitment to Conservation
 We will collaborate with members of the Bears Ears Inter-Tribal Coalition and the Utah Diné Bikéyah (UDB) to record and document their stories and/or memories about plants they use and their families use. In collaboration with the Natural History Museum of Utah's Community Outreach department, we will develop programs or activities that would most benefit those communities.

RESEARCH THEME AND TECHNICAL APPROACH:

Please identify which themes apply to your projects:

- Research Identified in Unit Science Plans (for National Monuments, National Conservation Areas, and Similar Designations)**
- Effectiveness Research**
- Standardized Inventory and Monitoring**
- Research Syntheses**
- Citizen Science**
- Other Management-Driven Research**
- All themes and goals apply**

Techniques, processes, methodologies:

We will collaborate with knowledgeable tribe members and BLM to select a subset of culturally important sites starting in Bears Ears National Monument. In general, these sites will possess significant archeological features and be reasonably accessible for field study. We suggest a total of seven sites per year (three sites for pilot Year 1) would be visited twice, once in spring (May-June) and once in the fall (Aug-Sept) to capture plant species with different phenologies. The vegetation survey will generally be done in the spring visit.

Objective 1: Landscape and archaeology. The landscape setting of each selected site will be described with respect to geographic orientation, topography, general geology, hydrology, and other ecologically-relevant variables. A record of site conditions that records the types and degrees of disturbance from fire, humans and grazing animals. A standardized set of photographic survey points will be established with available GPS accuracy and a series of photographs taken for archival purposes. We will complete site forms for the archaeological sites, documenting and describing the different site types and providing a summary of the artifacts, (lithic scatter, ground stone tools, ceramics, etc.), features (hearths, pits, middens, etc.) and architectural features (granaries, dwellings, adobe walls, etc.). We will also provide site sketches with GPS reference points in relation to major features.

Objective 2: Quantify vegetation. Multiple vegetation sampling methods suited to the structural changes (number and height of canopy layers, life forms of dominant species) encountered at the sites will be applied. Herbaceous and shrub canopy layers will be sampled using quadrat and line-intercept methods, respectively (Mueller-Dombois and Ellenberg 2003). Another method, point-centered quarter, will be used in woodland and forest types that have an overstory canopy of trees (Mueller-Dombois and Ellenberg 2003). The taxonomic identity, relative abundance (e.g. density, cover) and presence of food resources on plant species occurring in these samples will be used to inventory the potential dietary palette. Representative stands of each vegetation type are recognized by their dominant species and will be identified and described. We will avoid atypical landscape features, such as narrow canyons and small-scale drainages, which might introduce azonal plant communities into the sample. Once located in a homogenous, representative stand, the plot center is established. The plot center marks the intersection of two 50 m transects (fiberglass tapes) oriented along north, south, west and east compass points. This process will be repeated twice in each vegetation type and will be assigned a site number and a GPS location to each plot center. It is most likely that all vegetation types in the study will be comprised of shrub-dominated and herbaceous-dominated canopy layers, therefore the line-intercept cover measurements will be uniformly applied to all sites. The higher elevation sites with tree-dominated overstories will be subject to the point-centered quarter sampling technique, in addition to the line-intercept method (Louderback 2014).

Objective 3: Inventory and survey ethnobotanical species. An inventory of ethnobotanically important species will be generated based on ethnographies from the Colorado Plateau and Great Basin regions (Couture, Ricks, and Housley 1986; Steward 1933; Kelly 1964; Fowler 1986; Chamberlain 1911). We will also interview Native Americans, pioneer descendants and local community members living in the Four Corners region to document historic and contemporary uses of specific plants. These data will be entered into an existing online database, “Ethnobotanical Guides for the Arid West”, (<https://nhmu.utah.edu/native-plants>) (Figure 4). Developed in partnership with the BLM Applegate office, the database has a standardized format for the display of available ethnographic and botanical information on the plant species. It includes key characteristics for identification using minimally technical terms followed by photographs and information on habitat, season of growth, phenology and distribution. The database also includes cultural information, such as subsistence use (e.g. food, medicine, clothing, shelter, etc.), traditional significance, when and how the plant was gathered, and how it was processed. The online database also has data sheets for volunteers and citizen scientists to complete and can be uploaded to the website.

Online Resources

Gardner's yampah

Perideridia gairdneri

Description:
This forb appears as a perennial erect and slender plant that can grow between one and four feet tall. It can be identified by a set of basal leaves that are divided 1-2 times pinnately into 3-5 pairs forming many narrow subdivided lobes. Smaller leaves appear along the stem and are less often divided. Inflorescence appear as umbels with spherical clusters of 15-40 pinkish-white flowers. Stem grows from cylindrical tubers that can measure up to 8 centimeters long.

Habitat:
Perideridia gairdneri grows in many types of habitat including meadows, subalpine and alpine forests, from plains to moderate elevations.

Distribution:
This plant has a wide distribution, from southwestern Canada through California and east to New Mexico.

Ethnography:
The roots of this, and other plants within the genus Perideridia (referred to generally as yampah), are edible and are said to have a sweet, nutty taste. Many native groups consumed these roots, and they are often listed as a primary food source.
"From early spring well into summer root gathering was an economic activity of great importance. Women went each day to dig yampah, tu'nu'ju, mu'a, hu'nbul, pa'sigo', and other roots. These they prepared by boiling or by pit-roasting, or sometimes preserved by drying in the sun." (Nally 1932:100-101)

Figure 4. Screen shots of the opening page for the 'Ethnobotanical Guides for the Arid West' and the species page for *Perideridia* spp., published on the NHMU website. This ethnobotanical database was developed in partnership with the BLM Applegate Office (BLM CESU Assistance Agreement L15AC00099).

Proposed period of performance, primary goals and products:

We envision this as a five-year project, each year building upon the accumulated experiences, data and relationships. The size, diversity and complexity of National Conservation Lands in the Four Corners Region will require a multi-year, interdisciplinary and synthetic approach to develop effective management plans. Here we present an overview of those five years, with details provided for only Year 1.

Year 1: Consultation and Site Selection. We will meet with our BLM PO in May-June 2017 to suggest, discuss and select 3 archaeological sites in Bears Ears for the Year 1 pilot effort. The criteria for selection will include high tribal priority, BLM priority, size, complexity, access and perceived threats. If time allows, we will perform an early summer survey of those sites. The survey will begin the processes of data collection and methodological refinement to meet objectives 1, 2 and 3 (above). But our ***primary goal*** in this first year is to address the concerns and honor the knowledge of members of the Inter-tribal Coalition and UDB. It would also be wise at this point to discuss with the tribes what benefits they would like to see from this project. For example, they could recommend potato propagation, native plant exhibits, a teaching tool kit for local schools, learning gardens or other useful ways to ensure conservation and dissemination of results. **Products:** We will write a report to record progress in Year 1 and make preliminary management recommendations, especially for sites that are imminently threatened or have special archaeological and/or biological qualities.

Years 2 - 4: Consultation, Site Selection, and Objectives 1, 2, and 3. We imagine that years 2, 3 and 4 will require less initial planning than year 1. We will continue to meet with our BLM PO and coordinate with tribal members to prepare for the field seasons. But our ***primary, post-pilot goal*** will be to select 7 sites each year and accomplish objectives 1, 2, and 3 at each of those sites. Depending on research priorities of the BLM and tribal members, our study could be expanded to include other national monuments throughout the Four Corners region (e.g., GSENM, Vermillion Cliffs, Canyons of the Ancients). **Products:** Annual reports will be generated after each year and preliminary management recommendations will be incorporated.

Year 5: Synthesize and Interpret Data; Formulate Management Recommendations; Finalize Database; Accomplish Outreach and Public Benefits.

The synthesis of survey data will first take the form of distribution maps of archaeological sites and related plant resources. This will allow the analysis of patterns that could reveal ancient settlement, trade routes and plant cultivation. Vegetation data will be summarized in standard form, providing information on species composition, cover (dominance) and the abundance of plant resources. All ethnobotanically important species encountered will be entered into the database to include subsistence use, traditional significance, when and how the plant was gathered, and how it was processed. Preliminary management recommendations from Years 1 to 4 will be examined with a monument-wide perspective to prioritize sensitive areas and develop overall management strategies with the maximum possible efficiency. The relevance and practical application of these management strategies will be examined for other National Conservation Lands in the Four Corners region that have similar resource issues. And finally, we will work with the NHMU Community Outreach department to develop and implement a program and/or activity that would benefit all stakeholders.

Milestone / Task / Activity – <i>Pilot Year 1 only</i>	Start Date	Completion Date
Consultations and site selections	May 2017	June 2017
Surveys, data collection, method improvement (objectives 1, 2 and 3)	June 2017	October 2017
Data synthesis, preliminary management recommendations, report	November 2017	April 2018

OUTREACH AND PUBLIC BENEFIT:

The current paradigm for agricultural origins in the Four Corners is that people adopted exogenous domesticates (i.e., maize, beans and squash) instead of manipulating native plant populations. But we have strong evidence (Louderback and Pavlik, in review) that *Solanum jamesii*, a native potato to the Four Corners region, was not only used by people over 10,000 years ago, but that it might have been manipulated in ancient gardens.

Escalante Valley was named ‘Potato Valley’ by the first settlers (Woosley 1964) where *S. jamesii* was once ubiquitous and an important food source in historic times (Dunmire and Tierney 1995, Roundy 2000). Overgrazing in the early 20th Century dramatically altered the natural vegetation (Nelson 1952) and the species is now considered rare and imperiled in the region (Bamberg et al. 2003). In many parts of the Four Corners, the history and memory of this species are fading. From previous interviews in the field, we know it has been grown in gardens in Escalante, Canyon de Chelly and on Zuni reservations.

The proposed research will contribute a collaborative and multidisciplinary approach altering long-accepted paradigms regarding indigenous knowledge, agricultural origins and the domestication of wild plant species. And, at the local level, it will restore an ancient food crop to communities of the Four Corners region. Thus, the outcomes will not only alter our thinking about the origins of North American food crops, but also have broad, positive societal impacts.

QUALIFICATIONS, PAST PERFORMANCE, ACTIVE BLM COOPERATIVE AGREEMENT:

Key Personnel:

Dr. Lisbeth Louderback is Curator of Archaeology at the Natural History Museum of Utah and Assistant Professor in Anthropology Department at the University of Utah. Lisbeth has extensive experience in ethnographic and archaeological plant use, including the analysis of macro- and microbotanical remains (Rhode and Louderback 2007; Louderback 2014; Louderback et al. 2013; Louderback et al. 2015). She has developed a comprehensive ethnobotanical reference collection for the arid West and also studies paleoenvironmental change in the Great Basin and Colorado Plateau (e.g., Louderback and Rhode 2009). Her background is in archaeology, archaeobotany, paleoecology and vegetation ecology. She has done wide-ranging fieldwork in the Great Basin and Colorado Plateau. **Responsibilities:** Lisbeth will oversee the project; she will conduct vegetation surveys with Bruce Pavlik and ethnobotanical inventories with Nicole Herzog.

Dr. Bruce Pavlik is Director of Conservation at the Red Butte Gardens, University of Utah. Bruce’s research has focused on the ecology and physiology of plants native to western North America, including the conservation of endangered species. Ecological restoration has become central to his research program and recent projects have emphasized the design and active management of populations and communities using field-based, experimental approaches. He has authored or co-authored more than 60 scientific and popular publications in plant conservation, inventory, and ethnobotany (e.g. Pavlik 2008; Wilken et al. 1994). His research interests include the biology of founding populations, the role of adaptive management for resources *in-situ* and the development of restoration protocols for complex, species-rich ecosystems. **Responsibilities:** Bruce will conduct vegetation surveys and ethnobotanical inventories in the field. He will also aid in plant collection and identification, and provide botanical expertise.

Dr. Brian Codding is Associate Professor of Anthropology at University of Utah. Brian’s research focuses on the ecology of foraging economies, examining the ways in which populations interact dynamically with

their natural and social environments. His research interests include human ecology, behavioral ecology, hunter-gatherers, ethnoecology, ethnoarchaeology, anthropogenic impacts, data analysis, and spatial analysis and he has authored or co-authored over 40 publications. He is currently working on a project with the Navajo Dine on firewood use. His input, therefore, will be valuable when we collaborate with the tribal members. **Responsibilities:** Brian will be responsible for describing, documenting and mapping the landscape and archaeological settings. He will work with a graduate student to generate the maps for the annual reports.

Dr. Nicole Herzog is a Post-Doctoral Research Fellow at the Natural History Museum of Utah and in the Anthropology Department at University of Utah. Nicole is an experienced archaeologist in the arid West. She has worked as an archaeological consultant and as an independent researcher for over 10 years. In collaboration with Dr. James O'Connell, she conducted archaeobotanical research in Surprise Valley CA, which culminated in an ethnobotanical reference collection and an important publication on plant use in the Great Basin (Herzog 2014). Her background is in human behavioral ecology, dietary reconstruction, and paleoethnobotany and has broad field experience in the Great Basin and the Colorado Plateau. **Responsibilities:** Nicole will be in charge of uploading all information onto the ethnobotanical database, photographing plants and plant parts and working with Garrett Herbarium to voucher specimens.

Past performance:

1. In 2015 we were awarded an Assistance Agreement (BLM CA CESU Archaeological and Archaeobotanical Research Partnership L15AC00099). Through this award we established the framework for an online regional ethnobotanical database. We completed the project in January 2016 (screenshots see: Figure 4). The webpages include a publically available database which can be viewed at <https://nhmu.utah.edu/native-plants>. The database currently contains ethnobotanical data on seven species in the northwest Great Basin. As part of the Assistance Agreement, we also created an internal framework from which to continue to add ethnobotanical information to the database. The funds requested for this project will expand the database to include plants from the Colorado Plateau.
2. We recently completed archaeobotanical analyses for a large-scale CRM project documenting the macro- and microbotanical components of human diets for nine excavated sites throughout central and southern Utah (Louderback et al. 2016). We found evidence of maize, several common grasses and geophytes, and evidence suggesting consumption of a rare tuber (Four Corners potato) likely transported from southwestern Utah. Results will be published in a regional journal (Herzog et al. in prep).
3. Louderback and members of the Archaeobotany lab recently completed a high-quality macrobotanical reference collection at NHMU. This collection contains over 350 plant specimens from the Great Basin, Mojave Desert, and Colorado Plateau. These are cataloged and described, and are currently used as teaching collections for the University of Utah's Paleoethnobotany courses. They also serve as references for NHMU archaeologists, and will be used to establish a similar collection containing archaeological botanical specimens (in progress).

BLM Cooperative Agreements:

University of Utah is partners with the following Cooperative Agreements:

- Colorado Plateau CESU (http://www.cesu.psu.edu/unit_portals/COPL_portal.htm)
- Great Basin CESU (http://www.cesu.psu.edu/unit_portals/GRBA_portal.htm)
- Desert Southwest CESU (http://www.cesu.psu.edu/unit_portals/DESO_portal.htm)

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